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Volume XIX OCTOBER, 1932 Number 8

DISCUSSION OF THE PAPER ON "STRUCTURE OF CLAY AND ITS IMPORTANCE IN FOUNDATION ENGINEERING"

ABRAHAM WOOLF *

SINCE Mr. A. Casagrande's paper was published in April, 1932, there has been quite a bit of discussion in engineering circles about his statements concerning the mechanics of soil as applied to foundation engineering. The paper is, perhaps, one of the most interesting ones on the subject of foundation engineering since those published by Dr. C. Terzaghi. The paper is also brimful of "food for thought," as Mr. J. R. Worcester † puts it, and I think that one of the purposes of Mr. Casagrande's paper was to create such food.

There is no doubt that many facts stated in the paper seem a little too definite without too much support from either theory or actual field experience. However, those remarks which deal with the consolidation phenomenon are as complicated as one would dare indulge in; and, as Mr. Casagrande points out in his introduction, the theory is not new and may be obtained in Dr. Terzaghi's publications. The remarks which the author makes concerning the settlement of buildings, the pressure distribution under footings, the structure of a natural clay deposit, and finally the effect of disturbing or remolding natural clays, are opinions evolved after extensive research in the field of soil mechanics.

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* Junior Member, Boston Society of Civil Engineers.

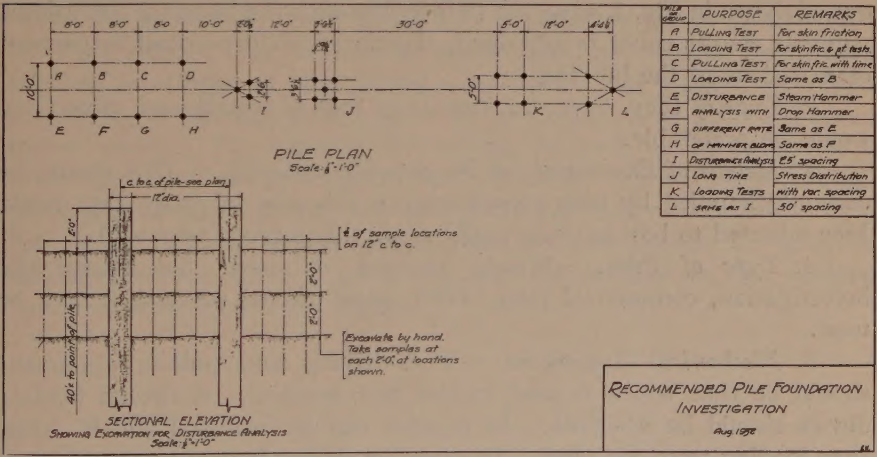
† Boston Society of Civil Engineers, JOURNAL, June, 1932.

Among other subjects of discussion which the paper has brought about, one in particular has been very definitely emphasized, and that is "the effect of pile driving on the settlement of the structure." No doubt this subject, being an everyday problem of the engineers in the vicinity of Boston, is quite an important one. The paper presents startling views on this subject, and points out that the piles tend to decrease the bearing capacity of a foundation (the term "bearing capacity of a foundation" meaning that intensity of load which will not cause a settlement exceeding a definite allowable value). According to the author there seems to be complete justification in his ideas. That disturbed clays present entirely different properties from undisturbed clays (clays in their natural state) is undoubtedly true; that piles do tend to disturb clays, when driven into clay, is obvious.

The writer has had occasion to design pile foundations under the direct supervision of experienced engineers. There is no doubt in his mind that, generally, the practice employed in engineering offices is justified. There are cases where piles driven into clay have completely changed the character of the clay. However, there are very few cases in the vicinity of Boston where pile foundations have caused excessive settlements over long periods of time. The author shows a hypothetical case in Fig. 18*c*, where the settlements are about two feet in fifty years. This settlement analysis, no doubt, does not check with actual experience here in Boston. Evidently, there exists some discrepancy between the opinions of Mr. Casagrande and the results of actual cases here in Boston. It would be well to consider the facts. Those structures which are fifty years old today, and which bear on pile foundations, have not the loads of the structures built in the past two decades. In fact, many of them have been abandoned and reconstructed. It would therefore be unreasonable to compare the settlement of these buildings with those which have been built recently. Then, it should be kept in mind that substrata conditions as presented in Fig. 18 of the paper are very rare in Boston; also, in many of the pile foundations here in Boston, which have produced small settlements, the piles are essentially point bearing piles, and therefore come under a different category than those which the author mentions. As a result, it seems unreasonable to expect a check between Fig. 18*c* of the paper and many actual pile foundations here in Boston.

Besides the question of the effect of pile driving on the settlement of a structure, we have the question of the validity of pile driving formulæ. Many cases have shown that values obtained from formulæ for piles driven in clay, which are sustained essentially by skin friction, do not check with the bearing power of the pile after a loading test has been made on the pile. Those values which are obtained from loading tests and which give the bearing power of the pile do not give the bearing capacity of the pile. The loading test is a short-time affair compared to the life of the structure. With the consolidation phenomenon of clay in mind, it is obvious that a pile, whose load test gives ½-inch settlement for 30 tons in two or three days, would settle perhaps 6 inches if loaded to 30 tons for ten or twenty years.

Another recent development has shown that piles driven in groups will cause local increase of stress at the center of the group. This results in increased settlements in the center of a structure, even though the design provides for fairly uniform loads per pile. The validity of any of the present theoretical stress distribution analyses in soils as regards pile groups or spread footings is, perhaps, doubtful; yet many observations have checked the theory within an average of 30 per cent. This, no doubt, is a fairly reasonable check when one considers the factors involved.


8'-0"
8'-0"
8'-0
10'-0"
3'-0⅝"
12'-0"
3'-6⅜"
30'-0"
5'-0"
12'-0"
4'-4½"
10'-0"
5'-0"
A
B
C
D
E
F
G
H
I
J
K
L
PILE PLAN
Scale: ⅛"-1'-0"
c to c of pile - see plan
12" dia.
2'-0"
2'-0"
2'-0"
℄ of sample locations on 12" c to c.
Excavate by hand. Take samples at each 2'-0" at locations shown.
40'± to point of pile
SECTIONAL ELEVATION
Showing Excavation for Disturbance Analysis
Scale: ½"-1'-0"
RECOMMENDED PILE FOUNDATION INVESTIGATION
Aug 1932

Pile or Group	PURPOSE	REMARKS
A	PULLING TEST	For skin friction
B	LOADING TEST	For skin fric. & pt. tests
C	PULLING TEST	For skin fric. with time
D	LOADING TEST	Same as B
E	DISTURBANCE ANALYSIS WITH DIFFERENT RATE OF HAMMER BLOWS	Steam Hammer
F		Drop Hammer
G		Same as E
H		Same as F
I	DISTURBANCE ANALYSIS	2.5' spacing
J	LONG TIME LOADING TESTS	Stress Distribution
K		with var. spacing
L	SAME AS I	5.0' spacing

FIG. 1

With the above facts in mind, and realizing that there will exist a difference of opinion among foundation engineers on the subject of pile driving, it seems that a thorough and extensive research program on pile foundations should be undertaken. The writer therefore proposes an investigation as shown in Fig. 1. The factors which could be determined are —

1. Disturbance of clay due to pile driving.
2. Skin friction and point resistance of piles.
3. Pile-driving formulæ as applied to bearing power of piles.
4. The stress distribution due to various pile spacing.
5. Actual settlement data for bearing capacity data.

The layout as shown is general in every respect, and many improvements could be made. However, the following factors should be analyzed:

1. *Location of Site.* — The best suitable site for such an investigation would be a vacant lot where the substratum is a homogeneous clay for a depth of about 80 feet. For a more practical investigation an actual foundation site would be ideal. With a revision of the layout as shown in Fig. 1, so as not to interfere with the building operations, valuable results could be obtained, together with the actual settlement observations of the building.

2. *Type of Clay.* — A clay similar to that of soft Boston Blue Clay would be preferable.

3. *Method of Excavating for Disturbance Analysis.* — This should be carefully handled by men experienced in this sort of excavation work. Men adapted to boring work would serve the purpose very well.

4. *Type of Piles.* — Wood, concrete, or both. To extend the investigation, commercial piles, which have proved successful, may be used.

5. *Mechanical Equipment.* — The driving and pulling apparatus should be that which is used in the best practice. A special loading device should be designed. As pointed out in Groups J and K, long-time loading tests are used. The loading device should be therefore of a substantial and durable design, as these tests are to be carried on for a period of five years or more. Benchmarks, recording devices and other apparatus should be employed which would give reasonable accuracy.

6. *Pervious and Cohesionless Soils — Sand.* — The layout shown in Fig. 1 may be applied to piles driven into sands. However, those portions relating to the disturbance analysis and the long-time loading tests may be excluded. In the case of sands, more emphasis should be made on the driving results, and the applicability of short-time loading tests and pile-driving formulæ.

7. *Laboratory Methods and Procedure.* — This phase of the investigation is, perhaps, the most important one. It is therefore very essential to have all the laboratory work done in a well-equipped soils laboratory by experienced men. The men in the field should be fa-

miliar enough with the problems involved in a soils laboratory to know how much soil material is required for soil analysis, and how the soil samples should be preserved and shipped. The test procedure should include, in a general way: Atterberg Limit tests, mechanical analyses, specific gravity tests, permeability tests, consolidation tests, and shearing tests.

It is obvious that an investigation, as proposed, would yield considerable interesting data and information concerning piles and pile foundations. Its applicability to foundation practice and design would be justified when the results obtained would check with actual observations on existing structures. It is therefore of utmost importance to obtain, in conjunction with this investigation, reliable settlement data, taken on permanent benchmarks over a period of years, of structures built on either piles, caissons or spread footings, together with comprehensive studies of the subsoil conditions. The variety of subsoil conditions in practice would make an investigation as proposed herein impracticable. The expense of carrying on such an investigation at each foundation site is, no doubt, unreasonable. Yet with one thorough investigation as proposed, and with extensive data of foundation projects, which would include construction methods, settlement data and subsoil analyses, there is no doubt that the solution to this problem would at least have been begun.

OF GENERAL INTEREST

BOSTON SOCIETY OF CIVIL ENGINEERS' EXCURSION TO WATER SUPPLY SOURCES FOR THE METROPOLITAN DISTRICT, OCTOBER 22, 1932

An excursion by members of the Boston Society of Civil Engineers and guests was made on Saturday, October 22, 1932, to the water supply sources of the Metropolitan District. About fifty persons made the trip in two buses furnished by the Boston & Maine Transportation Company, leaving the Engineers' Club, Boston, at 9 A.M., and returning at 7 P.M. Aside from the technical features of the trip, the members enjoyed, also, comfort of travel in the buses running on schedule time, the scenic views with autumn foliage, and exceptionally good box lunches served at the Ware River intake chamber, located at Shaft 8, at Coldbrook.

Historical Sketch of Water Supply

The present water supply sources of the Metropolitan District consist of the following reservoirs which were constructed approximately in the order named: Lake Cochituate (first used in 1848); the so-called Framingham reservoirs (built 1870–99), consisting of Framingham Reservoir No. 1, at the junction of the North and South Branches of the Sudbury River, Framingham Reservoirs Nos. 3 and 5, the latter now known as Sudbury Reservoir, and both being on the North Branch of the Sudbury River directly above Reservoir No. 1, Framingham Reservoirs Nos. 2, 4, 6 and 8, the three last named being now known as Ashland Reservoir, Hopkinton Reservoir and Whitehall Reservoir, respectively, and being on the South Branch of the Sudbury River above No. 1. This group of reservoirs, including Lake Cochituate, were all built by the city of Boston, before the formation of the Metropolitan Water District, with the exception of Sudbury Reservoir, which was started by the city but completed in 1898 by the Metropolitan Water Board, who took over the system in that year. Shortly thereafter the Metropolitan Water Board started the construction of a new reservoir farther west, on the Nashua River, later to be known as the Wachusett Reservoir. This was first filled in the spring of 1908. Water from this new reservoir goes through the Wachusett Aqueduct into the upper end of Sudbury Reservoir, and thence follows the existing aqueducts and pipe lines to the Metropolitan District distributing reservoirs at Chestnut Hill and Spot Pond.

The water from Lake Cochituate is brought into Chestnut Hill Reservoir through the Cochituate Aqueduct. The water from the other eight reservoirs in the Sudbury group was originally brought to Chestnut Hill through the Sudbury Aqueduct alone. Water from Nos. 1 and 2 is no longer used, and that from Ashland, Whitehall and Hopkinton, mainly as an emergency supply. In 1903 the Weston Aqueduct was built from the Sudbury Reservoir to Weston and beyond, connecting with Chestnut Hill. In 1926 a direct connection to Spot Pond was made from the terminal chamber of the Weston Aqueduct.

In 1926 the construction of a tunnel to tap the Ware River was authorized. At this time preliminary work looking toward the construction of a new reservoir on the Swift River was also authorized. The following year (1927) the construction of this new reservoir and the extension of the tunnel from the Ware River to a point of intake on the proposed Quabbin Reservoir in the Swift River Valley were authorized. The tunnel authorized in 1926 has now been completed from the Ware River at Coldbrook, in the town of Barre, to a point near Oakdale, at the upper end of Wachusett Reservoir, a distance of approximately thirteen miles. Intake works for the Ware River have been completed at Coldbrook, and the flood flows of the Ware River are now taken directly through this tunnel into the upper end of Wachusett Reservoir. An extension of the above-mentioned tunnel westward for about twelve miles to the Swift River is under construction, as well as portions of the main dam and dike and stream control works of Quabbin Reservoir.

A sketch map (Fig. 1) shows the location of the various structures.

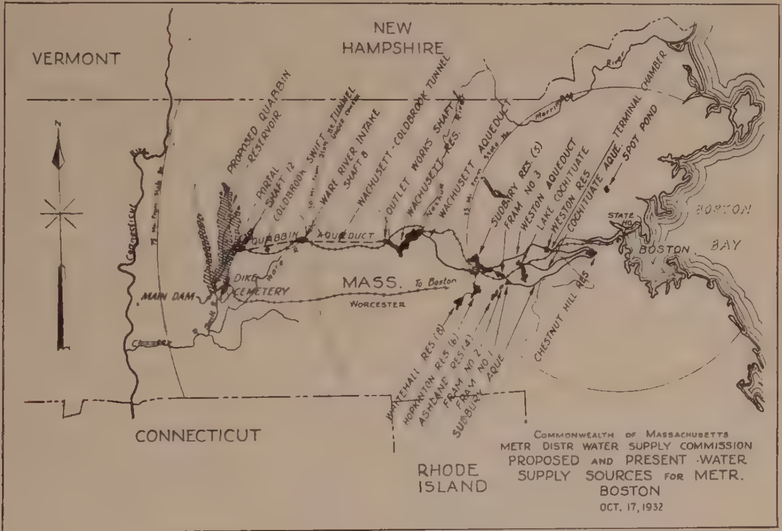


FIG. 1

Points of Interest

The first point of interest in connection with the water supply was the terminal chamber of the Weston Aqueduct located on the opposite bank of the Charles River from Norumbega Park.

Some six and one-half miles farther along, the route crossed Lake Cochituate. Just before crossing the lake the intake chamber of the aqueduct was seen on the right-hand shore. This was the first publicly owned water supply, and was taken over by the Metropolitan Water Board in 1898. At the present time it is used only for an emergency source of supply.

Then the route passed through Cochituate Village and swung just east of Framingham Center, on to the newly constructed Boston–Worcester turnpike. About one and one-half miles beyond the Center, the upper end of Framingham Reservoir No. 1 was crossed. On the immediate right was seen the earth dam, with stone masonry overfall, of No. 3 Reservoir.

Looking to the right, across Basin No. 3, there was seen in the distance the large masonry dam of the Sudbury Reservoir, which until 1908 was the chief storage reservoir of the Metropolitan Water District. Water from Sudbury Reservoir is carried into the Metropolitan District either through Basin No. 3, a short stretch of pipe line, and the Sudbury Aqueduct, or through the Weston Aqueduct. A turn to the right off the Worcester turnpike led to the Sudbury Reservoir.

This is the last that was seen of the Metropolitan Water System until the party reached Clinton, just below the huge masonry dam of the Wachusett Reservoir. This reservoir is now the largest single source of supply for the Metropolitan District. The dam was started in 1900, and the reservoir was first filled in the spring of 1908. The dam is 971 feet long, including abutments, and has a maximum height above rock foundation of 207 feet and a height above the valley floor of 115 feet. Beyond the northwesterly end of the dam is a waste weir section 452 feet long. The stored water passes through the power house, through four 1,340-horsepower turbines generating electrical energy, and into the twelve-mile Wachusett Aqueduct. The first two miles below Wachusett Reservoir are in rock tunnel. The next seven miles consist of a masonry aqueduct which includes the Assabet River bridge. This section terminates at a gate house in Northborough, and from here the water travels for three miles in an open channel which flows into Sudbury Reservoir.

Leaving the dam, the party passed through Clinton and along the so-called North Dike and northerly side of the Wachusett Reservoir.. This dike is made from the soil which was obtained from stripping the entire bed of the Wachusett Reservoir. It has a volume of about 5,500,000 cubic yards, exceeded only by the Gatun Dam at the Panama Canal and the Saluda Dam in South Carolina, which have 22,000,000 and 11,000,000 cubic yards, respectively.

The next stop was made at Shaft 1, the outlet shaft of the new tunnel which has just been constructed between the Ware River at Coldbrook and the upper end of Wachusett Reservoir. It is adjacent to the semi-circular dam across the Quinapoxet River, which was built at the time of the construction of the reservoir and has no connection with the outlet works. At the outlet works provision has been made for the future installation of a turbine for the development of electrical power after Quabbin Reservoir is completed.

The party proceeded to Shaft 8, where the Ware River Intake Works are located. Just after leaving Shaft 1 and turning right up the hill in Boylston, the route passed the Wachusett Country Club. A view back from this point gives a magnificent view of the Wachusett Reservoir. While the party was stopping at Shaft 8 for lunch, the operation of the siphon spillways was explained in detail. Briefly, the water is taken directly from the river into the tunnel by siphon spillways, the rate of diversion being automatically controlled.

After lunch the party went to Shaft 12 and the portal at the westerly end of the Coldbrook–Swift tunnel which is now under construction. This is an extension of the Wachusett–Coldbrook tunnel, completing the Quabbin Aqueduct, through to the Swift River Valley, where a reservoir fully six times as large as Wachusett is now in the process of construction. Here will be seen one of the construction shafts of the tunnel as well as the lower reservoir intake. The total length of tunnel from this new reservoir through to the outlet works at Shaft 1 is 24.6 miles, the longest continuous tunnel in the world, with the possible exception of one projected and partly built for distribution in New York City. It is large enough to accommodate a one-man electric car.

The intake to the tunnel is from the existing Quabbin Lake, the level of which will be raised 95 feet.

Leaving Shaft 12 the party proceeded southerly through the villages of Greenwich, Smiths and Enfield, three of the seven villages to be inundated by the new reservoir, to the site of the main dam at the Enfield–Ware town line. The route continued from Shaft 12 southward about three miles along the east branch of the proposed reservoir. This branch extends approximately eleven miles north of Shaft 12 and five miles farther south to the proposed dike across Beaver Brook. Leaving the east branch of the reservoir, the party continued for about two miles along a connection berween the east and west branches and then south along the west branch for a distance of about two and one-half miles to the main dam. This branch has a total length of about twelve miles. At the main dam the party went through the diversion tunnel which has been built to take care of the Swift River during the process of construction of the main dam. This dam will rise about 150 feet above the floor of the valley, and will, it is expected, be an earth dam with a concrete cut-off below the valley floor, consisting in part of caissons sunk to bedrock. One caisson was visible.

There was not sufficient time to visit the dike site where another similar dam will be built across Beaver Brook to prevent water from overflowing the Swift–Ware divide into the Ware River. The construction of this will be very similar to that at the main dam.

The route then went over a portion of a newly constructed highway built to replace one to be eventually inundated, stopping briefly to drive through the new cemetery which is being built to take care of all the bodies that have to be moved from various cemeteries which will be flooded out when the new reservoir is completed. Provision is made for some 5,000 bodies.

The inspection trip was concluded at that point and the return trip was made via Ware, West Brookfield and Worcester.

The excursion was arranged through the courtesy of Mr. Frank E. Winsor, Chief Engineer of the Metropolitan District Water Supply Commission. Details were worked out by a committee consisting of L. E. Moore, K. R. Kennison and E. N. Hutchins.

Special Committee to Study Revision of General Laws of Massachusetts relative to Sewers

Mr. Ralph W. Horne, President of the Boston Society of Civil Engineers, has appointed a committee of five to consider the matter of changes in the General Laws of Massachusetts that may be desirable concerning the methods of sewer assessments or rentals and the advisability of putting sewerage systems on a self-liquidating basis. The committee consists of Frank A. Marston, Chairman, George A. Sampson, Gordon M. Fair, Edward Wright and Ralph W. Horne.

PROCEEDINGS OF THE SOCIETY

MINUTES OF MEETINGS

Boston Society of Civil Engineers

September 21, 1932. — A regular meeting of the Boston Society of Civil Engineers was held this evening in Chipman Hall, Tremont Temple, and was called to order by the President, Ralph W. Horne, at 7 P.M.

There were about 60 members and guests present. Previous to the meeting 50 of the members attended the usual buffet supper.

The President announced the death of the following members: Fred E. Hess, died May 1, 1932, a Junior since December 19, 1928; William Wheeler, died July 1, 1932, a member since May 20, 1896; Orville J. Whitney, died August 21, 1932, a member since September 20, 1899.

The Secretary stated that the following had been elected to membership:

Grade of Member: Oliver G. Julian, E. B. Myott.

Grade of Student Member: Robert Abel, William R. Bauer, Joseph Bocon, Jr., Walter E. Butler, John M. Chase, Frank J. Columbo, Robert G. Cox, Charles W. Crouch, Herbert D. Gray, Jr., Rolf E. Hamstrom, Samuel Katseff, Philip J. Lacava, Harry P. Loftus, Joseph J. Macaione, Milton Mack, Angelo Massa, John A. Metcalf, Wilbur C. Nylander, Everett F. Perkins, Warren Peterson, Raymond C. Pressey, Arent B. Schow, Yale Shapiro, Anthony Tedesco, Vaino A. Tirri.

The President introduced the speaker of the evening, Mr. H. P. Eddy, Jr., of Metcalf & Eddy, who gave a paper on "New Incinerators at Washington, D. C." The speaker described the various steps in the consummation of these projects, including the governmental authorization, the unusual and attractive designs for the buildings as well as their technical features.

These plants are built for the disposal of municipal rubbish for the District of Columbia. One plant has a capacity for burning 425 tons and the other 170 tons of municipal rubbish in twenty-four hours. Acceptance tests of these two new incinerators are expected to be made about the first of October.

At each plant rubbish is handled from the receiving bin to the furnaces by means of grab bucket cranes. Other features include flat suspended arches over all furnaces, combustion chambers and flues, water-sealed ash gates with quenchers and thermostatic control of excess air admitted over the top of the fires to hold down the temperature of the refractories which otherwise might be excessively high.

The paper was illustrated by lantern slides. A general discussion and question period followed the paper.

The meeting adjourned at 9 P.M.

Everett N. Hutchins, *Secretary.*

October 19, 1932. — A regular meeting of the Boston Society of Civil Engineers was held this evening in Chipman Hall, Tremont Temple, and was called to order by the President, Ralph W. Horne, at 7 p.m. About 145 members and guests were present. The usual buffet supper was served to 69 persons.

The President announced the death of the following: Heywood S. French, who died October 2, 1932, a member since May 20, 1891; John R. Freeman, who died on October 6, 1932, a member since January 19, 1881. He was a Past President of the Society and had been an Honorary Member since September 19, 1917.

Resolutions on the death of John R. Freeman, Past President of the Society and an Honorary Member, were, by vote of the Board of Government at its meeting held today, presented to the meeting of the Society and read by Past President Harry E. Sawtell.

Resolutions on the Death of John R. Freeman

In the death of John R. Freeman the Society has lost one of its most distinguished members and an engineer of international reputation.

He joined the Society in 1881 and was therefore one of its oldest members in service. He was elected President of the Society in 1893 and Honorary Member in 1917, thus having been given the highest honor which the Society could confer upon him.

His interests were broad, covering business, engineering and education. Some of his investigations were so original that if made at the present time they would be classed as research. His interest in educational matters, particularly that branch relating to engineering, was so great as to cause him to expend a large amount of time and money in its furtherance, especially in the subject of hydraulics, and induced him to establish three funds, one of which was with the Boston Society of Civil Engineers, the interest from which is to be devoted to the encouragement of young engineers, with special reference to the science of hydraulics.

Although he was highly honored by other engineering societies in this country and abroad, his interest in the welfare of the Boston Society of Civil Engineers never lapsed. His advice and guidance were of great value.

Be it, therefore, resolved that this expression of appreciation be adopted by the Board of Government and presented to the Society at a regular meeting for approval, and be spread upon the minutes of the meeting, and a copy sent to the family of Mr. Freeman."

Voted, That the Resolutions on the death of John R. Freeman be adopted and spread on the records of the Society and that an engrossed copy be sent to Mr. Freeman's family.

The Secretary reports that the following members have been elected by the Board of Government on October 19, 1932:

Grade of Member: Glennon Gilboy.

Grade of Student Member: Robert Ray Balmer, Jr., Reginald A. Barron, M. Paul Craven, James L. Dallas, James N. DeSerio, Albert E. Holbrook, Carl H. M. Johnson, Warren E. Marston, Joseph A. Meninna, Lester S. Perry, Elford H. Richardson, J. H. Wakenigg, Walter F. Wolfrum.

Past President Frank M. Gunby, also Vice-President of the Emergency Planning and Research Bureau, Inc., outlined the accomplishments of the Bureau during the past year since January. He stated that the Bureau has kept engineers who are in dire circumstances employed at a small rate of pay on projects of distinct value to the profession and to the communities, — projects which have not been in competition with any work available to practicing engineers. He urged the members to contribute generously to the campaign for funds to be inaugurated soon to continue this work during the coming winter.

Prof. J. B. Babcock, 3d, announced a series of free courses offered by Massachusetts Institute of Technology, for the benefit of unemployed engineers and architects.

The President announced details of the excursion to be made on Saturday, October 22, 1932, to the work under way on the additional water supply for the Metropolitan District, including tunnel, intakes, river diversion works and site of new dam.

Voted, That the Board of Government be authorized to use so far as necessary the current income from the Permanent Fund for current expenses of the Society.

This matter will be presented for final action at the next meeting of the Society.

The President then introduced the speaker, Past President Frank E. Winsor, Chief Engineer of the Metropolitan District Water Supply Commission, who gave a paper on the "Construction and Operation of the Metropolitan District Ware River Tunnel." This project for additional water supply for the Metropolitan District will add 200,000,000 gallons per day from a reservoir 40 square miles in area near Enfield, through a tunnel 25 miles in length to Wachusett Reservoir at Clinton. The talk was illustrated by lantern slides.

The meeting adjourned at 9.15 P.M.

EVERETT N. HUTCHINS, *Secretary*.

Sanitary Section

OCTOBER 5, 1932. — A meeting of the Sanitary Section, Boston Society of Civil Engineers, was held on October 5, 1932.

Seventeen members and guests attended dinner at Patten's restaurant at 6 P.M.

The meeting was called to order in the Society rooms at 7.15 P.M. with 27 members and guests present.

Arthur D. Weston, Director and Chief Engineer of the Division of Sanitary Engineering, Massachusetts Department of Public Health, spoke on "The Construction of Sanitary Works for Unemployment Relief." The relationship of the Reconstruction Finance Corporation to such works in Massachusetts was considered.

Among those who took part in the interesting discussion which followed were Messrs. Whitman, Taylor, Fales, Horne and Pierce.

The meeting adjourned at 9.15 P.M.

FRANK L. FLOOD, *Clerk*.

Designers Section

OCTOBER 13, 1932. — The regular meeting of the Designers Section was called to order by the Chairman at 6.10 P.M. in the Affiliation Rooms.

The reading of the minutes of the May meeting was dispensed with to save time.

The subject of the evening was "Lumber, Its Design and Uses."

The Chairman introduced the four speakers in the following order: Prof. Irving H. Cowdrey of Massachusetts Institute of Technology; Mr. Stuart N. Huckins of Geo. McQuesten Company and Tim-Manson-Huckins Company; Mr. Frank H. Alcott, Structural Engineer for National Lumber Manufacturers Association; Mr. Edward Roemer, Building Commissioner of the City of Boston.

Professor Cowdrey gave a summary of the results of testing many wooden beams at Massachusetts Institute of Technology, the tests having been carried on over a period of years. The average results and the maximum deviations were very interesting.

Mr. Huckins discussed the relation of the engineer and lumber dealer. He also pointed out the economy of using the better grades of timber having higher allowable working stresses.

Mr. Alcott presented a method of explaining the action of beams to men who have had little educational training. He then spoke of the challenge of other materials to displace wood for home construction.

Mr. Roemer had intended to speak on "Grade Marking of Timber," but due to a recent change in the use of this marking he did not discuss it. He spoke in a general way on the topic of timber.

The meeting adjourned at 8 P.M., after a brief discussion.

Forty-three members and guests were present.

HERMAN G. DRESSER, *Clerk*.

APPLICATIONS FOR MEMBERSHIP

[November 20, 1932]

THE By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of fifteen (15) days from the date given.

For Admission

Beigbeder, Paul Alfred, Roslindale, Mass. (Age 22, b. Pau, France.) While a student at Northeastern University was employed in several machine shops and drafting rooms, with B. F. Sturtevant Company, F. S. Payne, Cambridge, Kinney Manufacturing Company, Jamaica Plain. Refers to *H. B. Alvord, C. O. Baird, C. S. Ell, W. E. Nightingale.*

Crane, William A., Boston, Mass. (Age 37, b. London, England.) Educated in public schools of Massachusetts; two years at Rindge, Cambridge; graduate of Bryant & Stratton's, and entered the contracting field at the age of twenty-one and is now owner of the Crane Construction Company. Refers to *C. R. Gow, L. C. Wason.*

Edwards, Gail P., Cambridge, Mass. (Age 37, b. Chicago, Ill.) Had degree B.A., University of Illinois, in 1918; M.S. in 1921 and Ph.D. in 1923. In 1918–19, water supply service, A. E. F.; from 1919–23 was chemist, Illinois State Water Survey; 1923–32, research chemist, Sanitary District of Chicago. Is now a graduate student in Harvard Engineering School, sanitary engineering department. Refers to *S. E. Coburn, G. M. Fair, Albert Haertlein, Langdon Pearse.*

Pierce, R. Whitney, Watertown, Mass. (Age 26, b. Worcester, Mass.) Graduate of Cambridge High and Latin School in 1926; entered Wentworth Institute in class of architectural construction and graduated, 1927–29. In July, 1929, was admitted for temporary work on the Board of Aerial Survey, which appointment terminated December 31, 1929. Has taken special surveying course at Franklin Union and evening courses in railroad surveying, physics and highway engineering at Northeastern University. May 7, 1930, was employed by the Edison Electric Illuminating Company as draftsman, and still with them to date. Refers to *C. W. Banks, E. L. Johnson.*

Tangen, George Henry, Randolph, Mass. (Age 22, b. Hyde Park, Mass.) Student at Northeastern University, 1928, 1929 and 1930. Co-operated with the town of Milton sewer department during the years spent at the University, and has continued on full time from 1930 to date. Refers to *C. F. Joy, Jr., H. F. Lord, J. W. Rollins, R. S. Slayter.*

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DEATHS

Heywood S. French . .	Oct. 2, 1932
John R. Freeman . .	Oct. 6, 1932
Harrison W. Haywood .	Oct. 18, 1932

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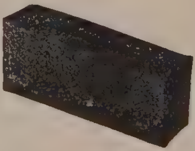

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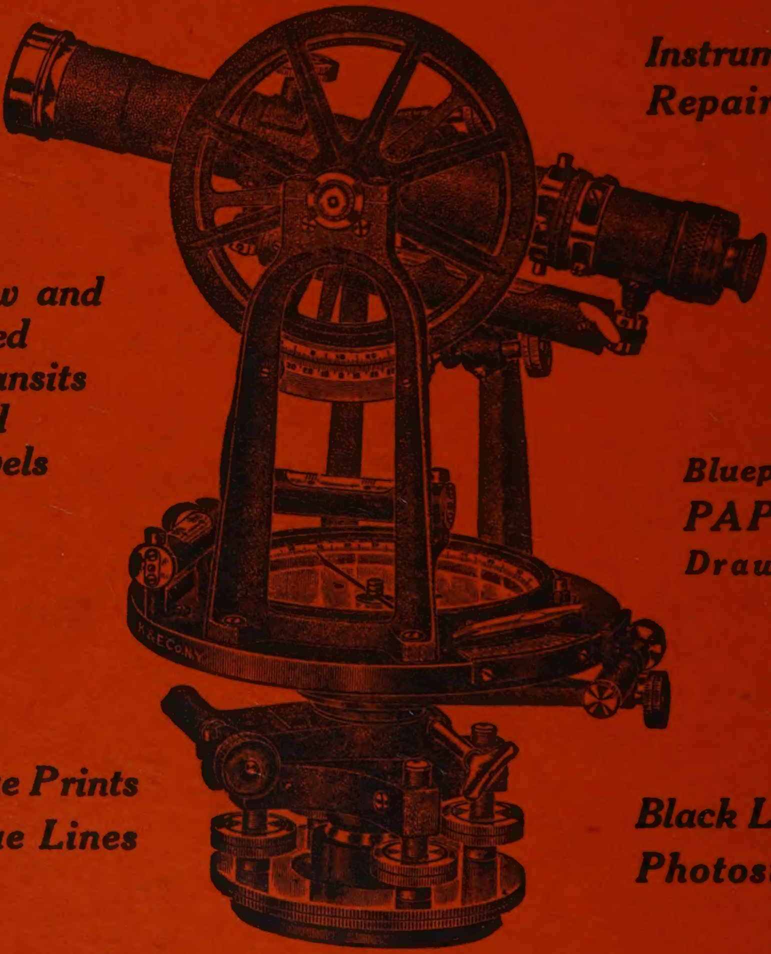

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